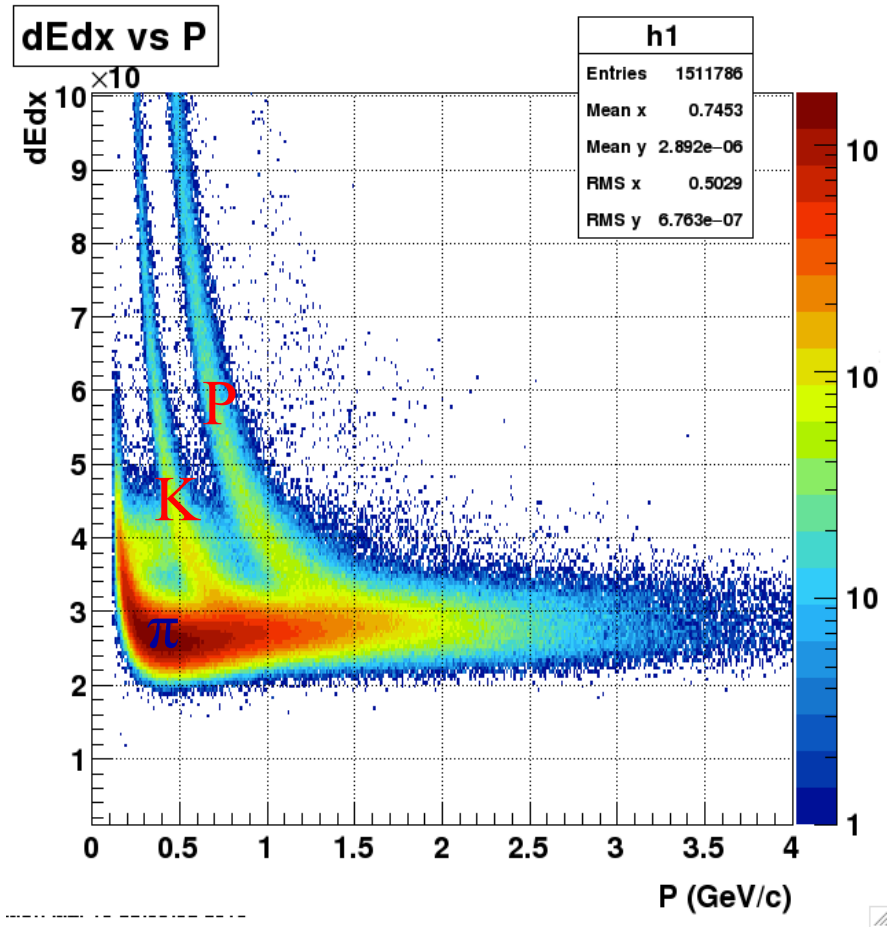
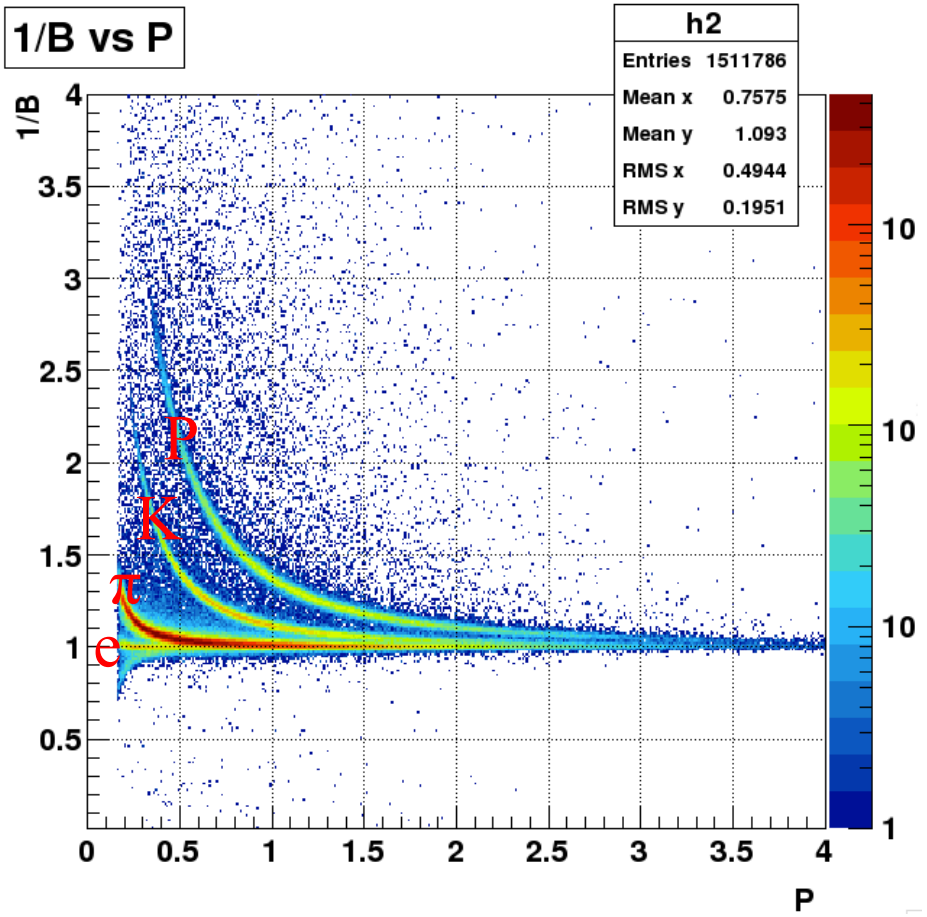
Gamma tomography
Run14 Au Au 200 GeV
For day 166 (P15ic) with HFT

Quality Cuts

DCA < 3 cm	Track DCA [will be removed to see TPC IFC]
|Zvtx|<10 cm	Z-vertex ---> harder cut is needed [<5cm]
FitPoss >0.52	Ratio of fitted points to hit points helps to avoid split tracks
nFit(TPC) > 20	Number of fitted TPC hits
$\|\eta\| < 1$	Track Pseudorapidity
|nSigE| < 2	Electrons dEdx
$\|1/\beta-1\|<0.03$	TOF cut
$\cos(\theta)>0.98$	Angle –between- two electrons
DCA<0.1cm	DCA–bet- two electrons [also tried <0.05]
Sign(1*2)<0	Sign of pairs has to be <0
Mass < 0.06	Inv. Mass
PIX1,2>=0,1	# Hits in PXL layers for track 1,2



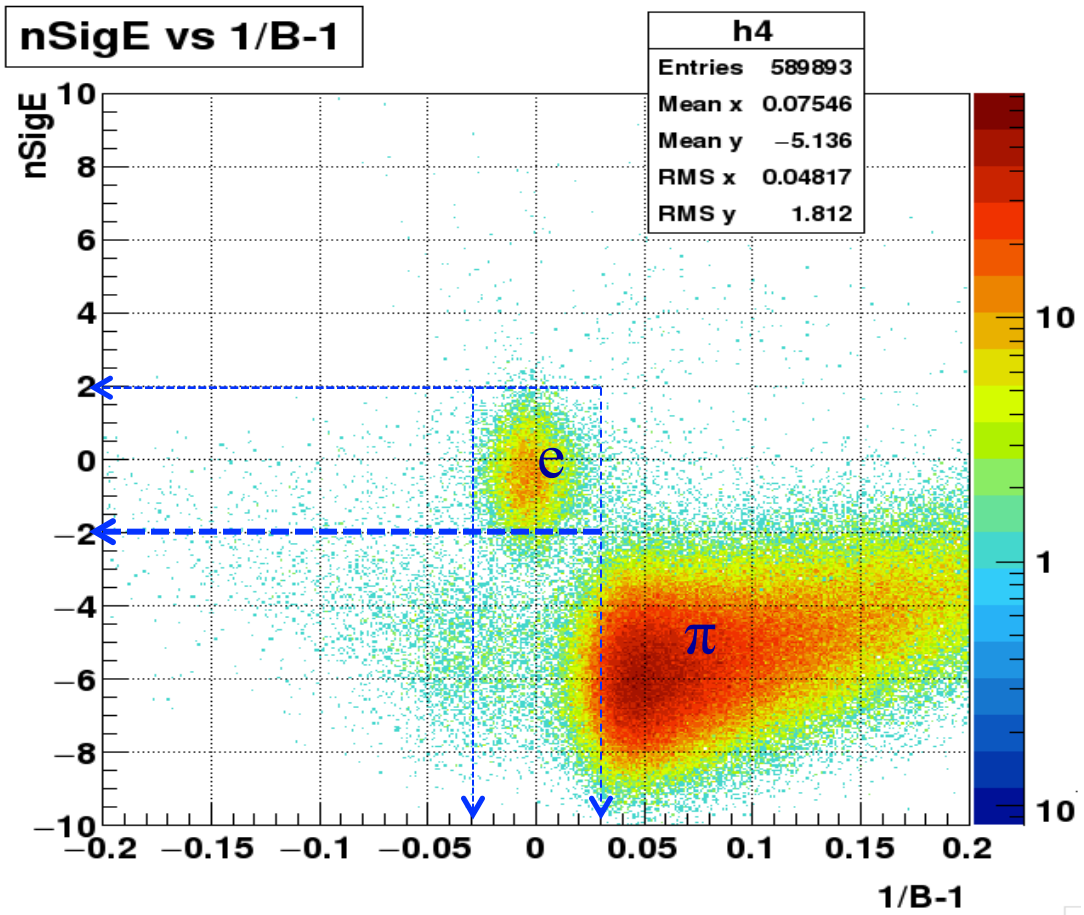
TPC dE/dx vs P



TOF 1/β vs P

Electron's band could be seen at low momentum

Before any applied cuts



NσE vs 1/β-1 at low P<0.5 Gev/c

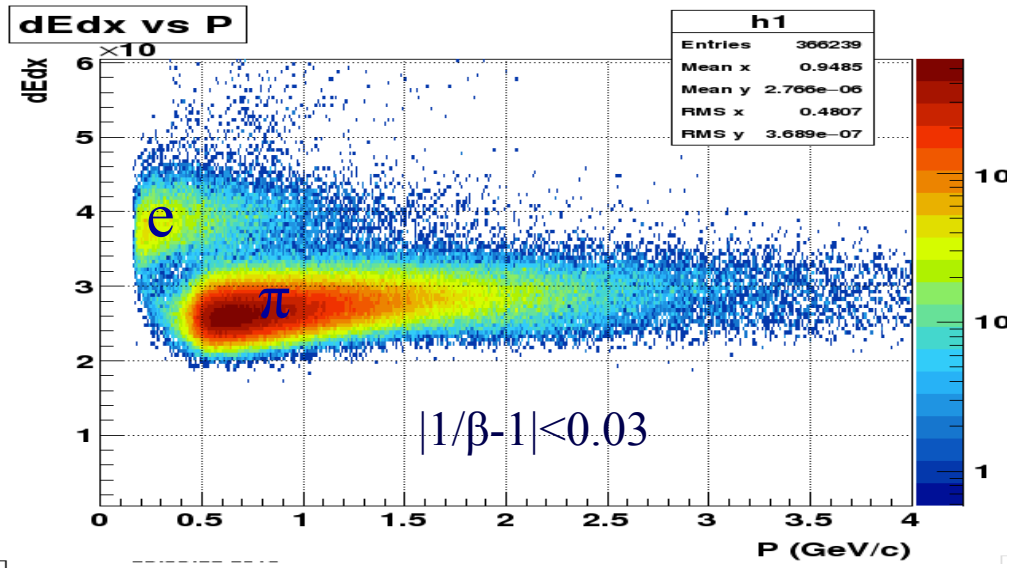
Electron's band can be selected by applying the following cuts |NσE|<2 and |1/β-1|<0.03

The impact of these two cuts

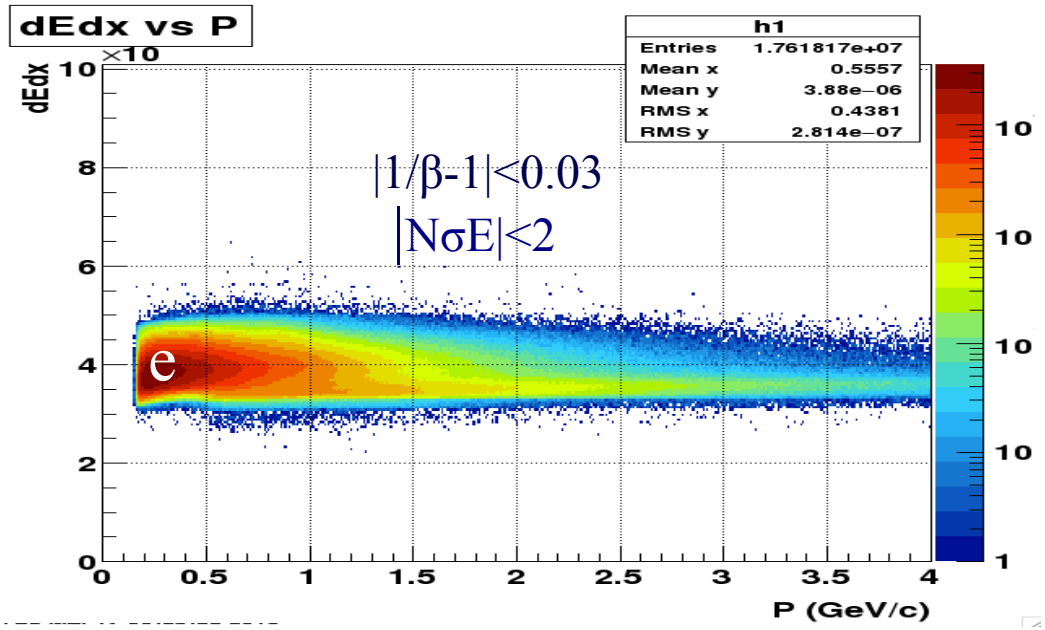
Next

3/17/15

ToF cut helps to reject hadrons bands.

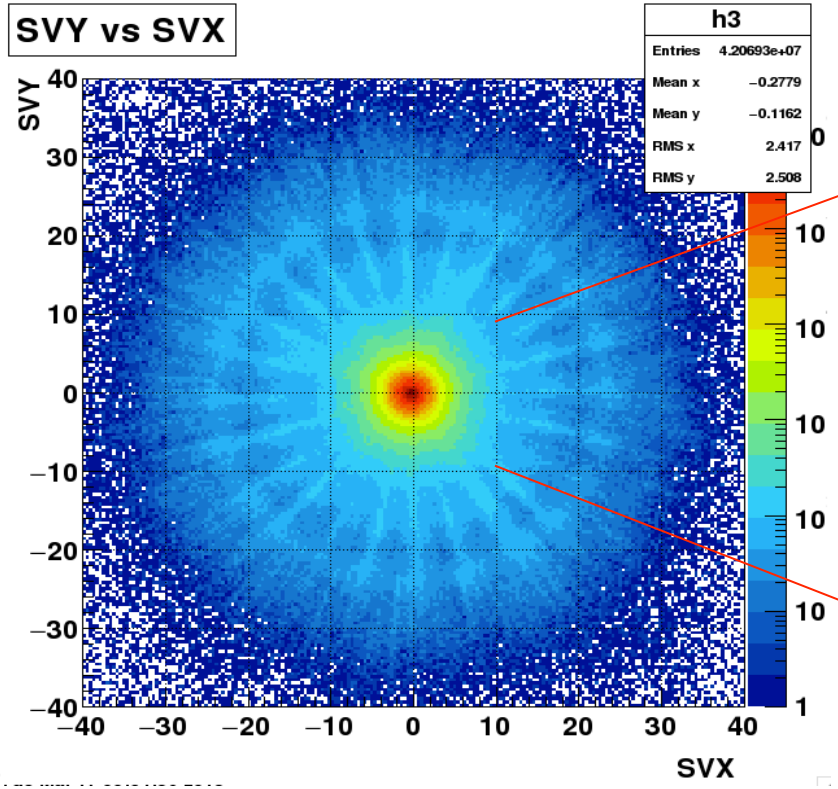


TPC dE/dx vs P



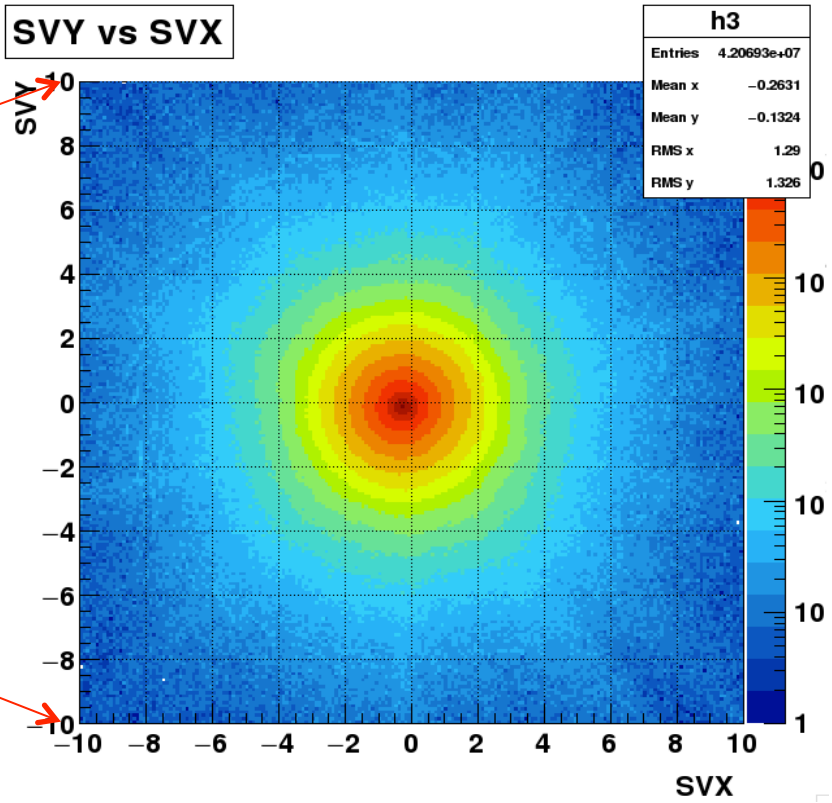
Highly electrons-enriched band left after applying TPC and ToF cuts.

TPC dE/dx vs P



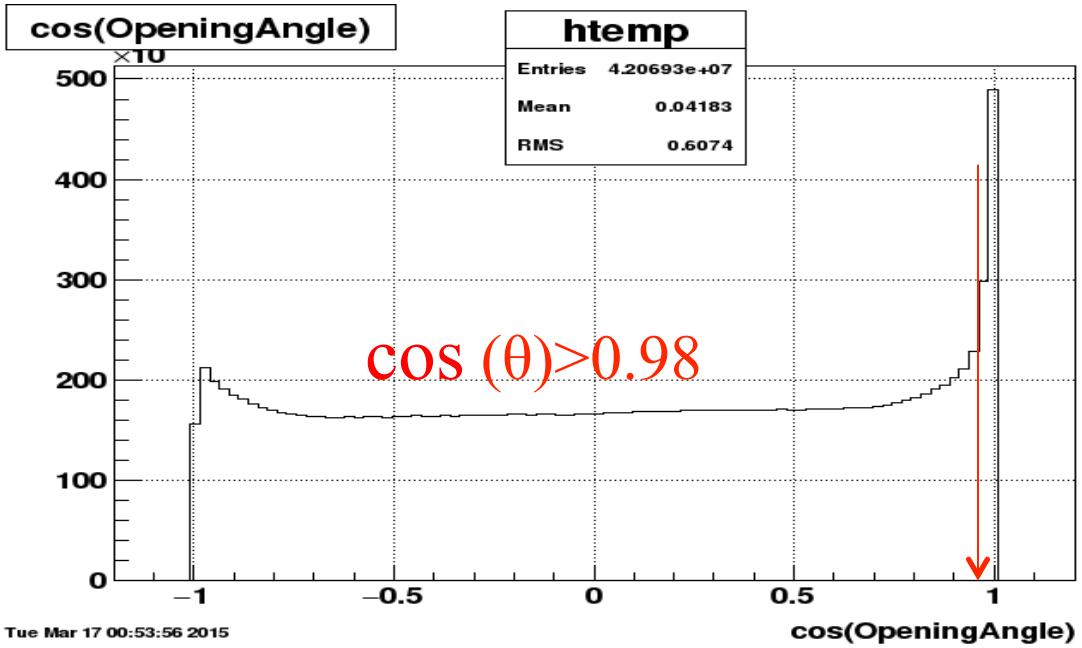
(Y VS X) component of secondary vertex

Zoomed to see the HFT and BP

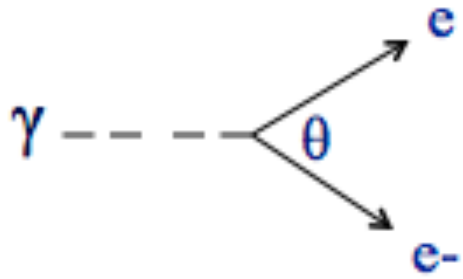


(Y VS X) component of secondary vertex

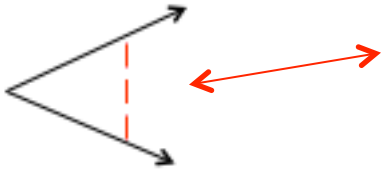
Next is to optimize some quality cuts in the pairs level to clean more in order to get a clear HFT layers



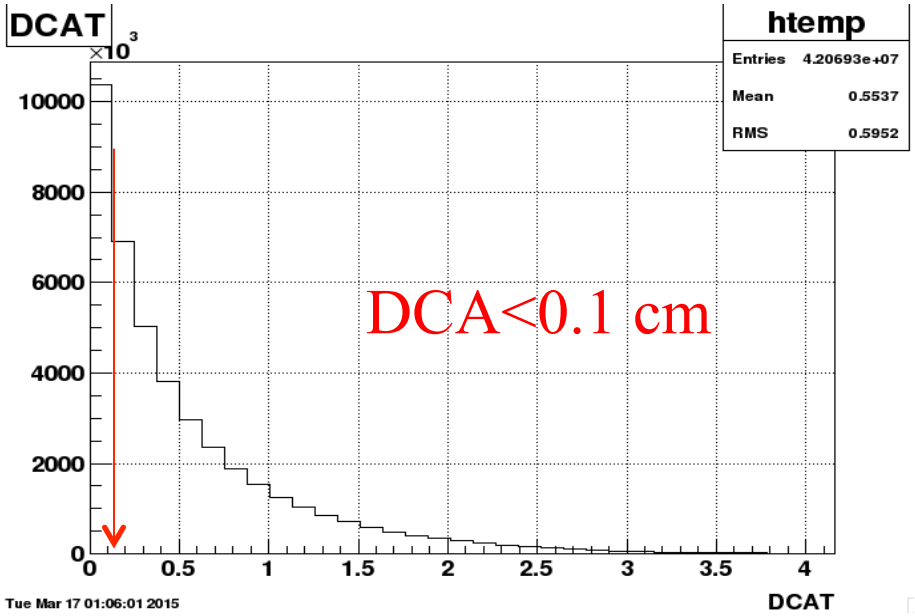
Cos(θ) of the opening angle between two daughters



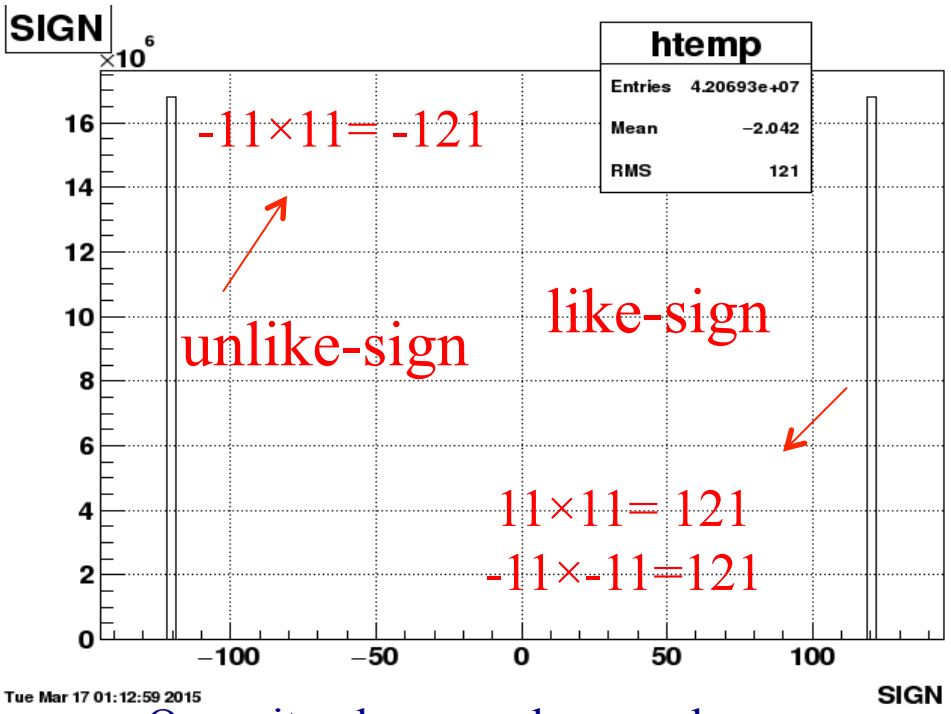
The idea is to make sure to select the pairs that come from the same gamma. By applying cos(θ)>0.98 it will select the pairs which have almost θ ~ 0



By making the distance of closest approach between two daughters smaller than 0.1 cm, we assure not to count fake electrons.



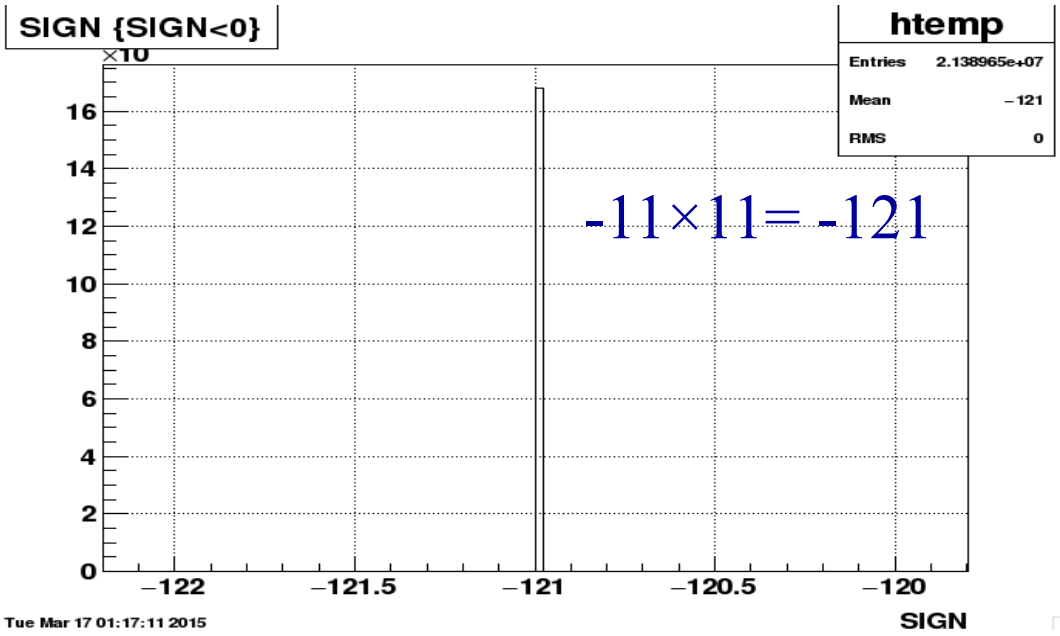
Distance of closest approach between two daughters



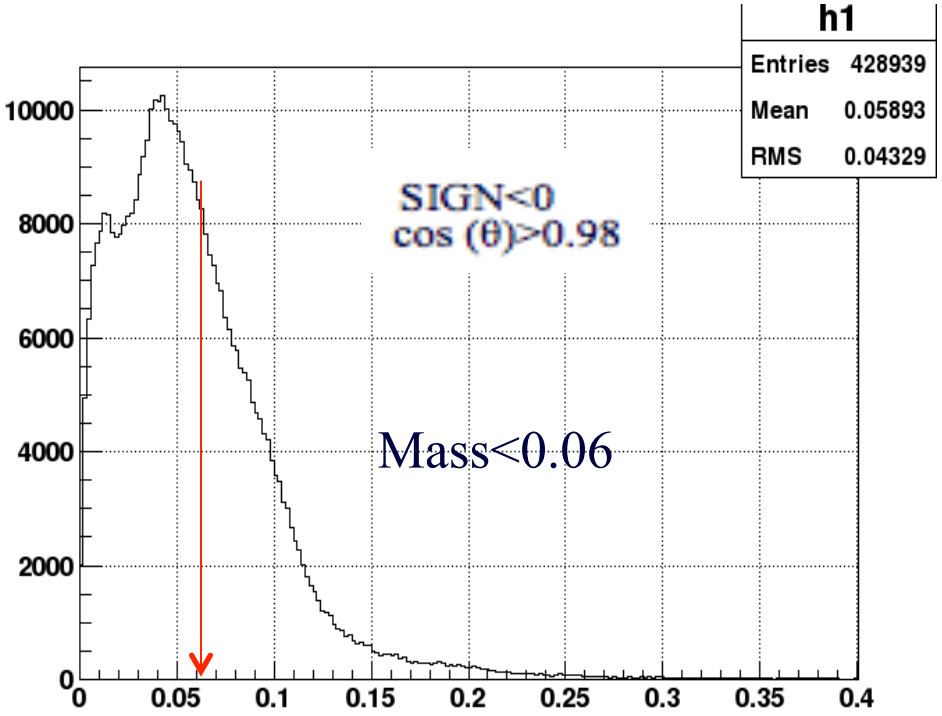
Opposite-charge and same-charge electrons

The PDG of the electron =11 and -11 for the positron, so combining electron tracks with all other opposite-charge (unlike-sign) or with all other same-charge (like-sign)

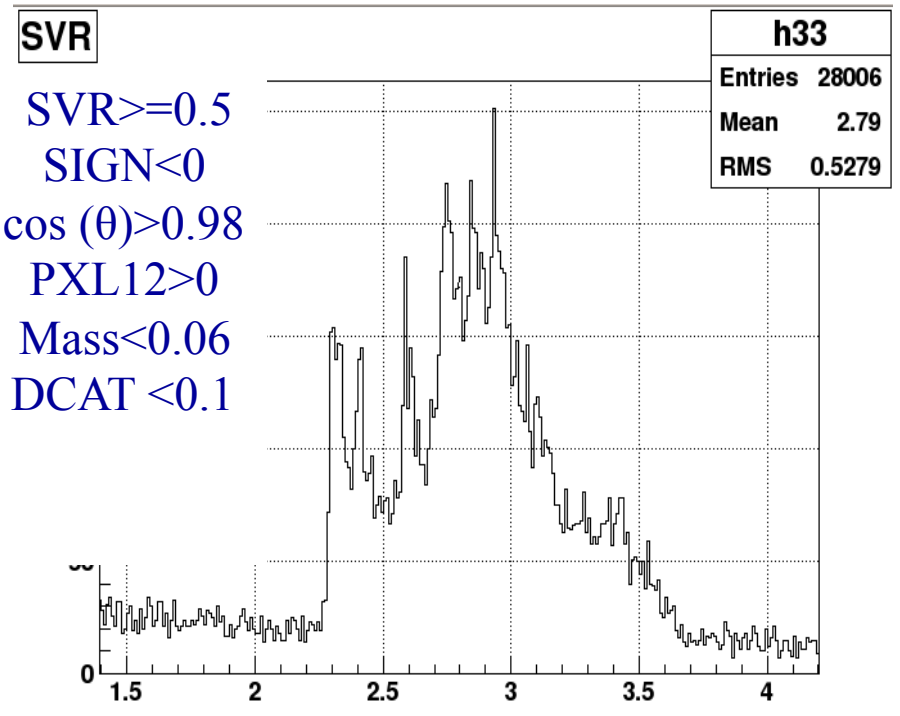
By applying the cut of SIGN<0, it just selects the unlike-sign



Opposite-charge which is unlike-sign for e and e-



The invariant mass

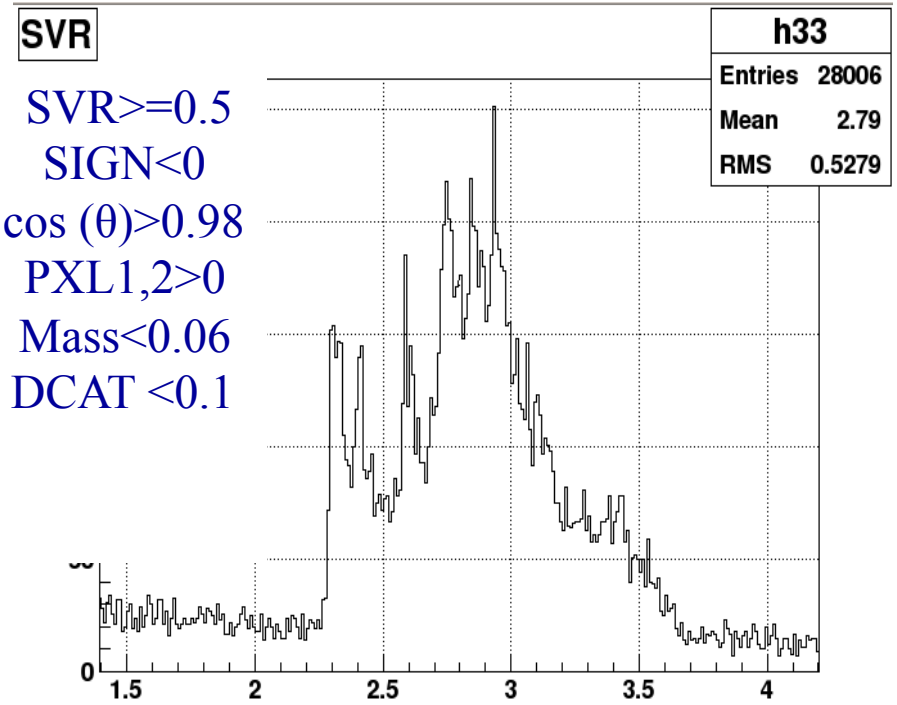


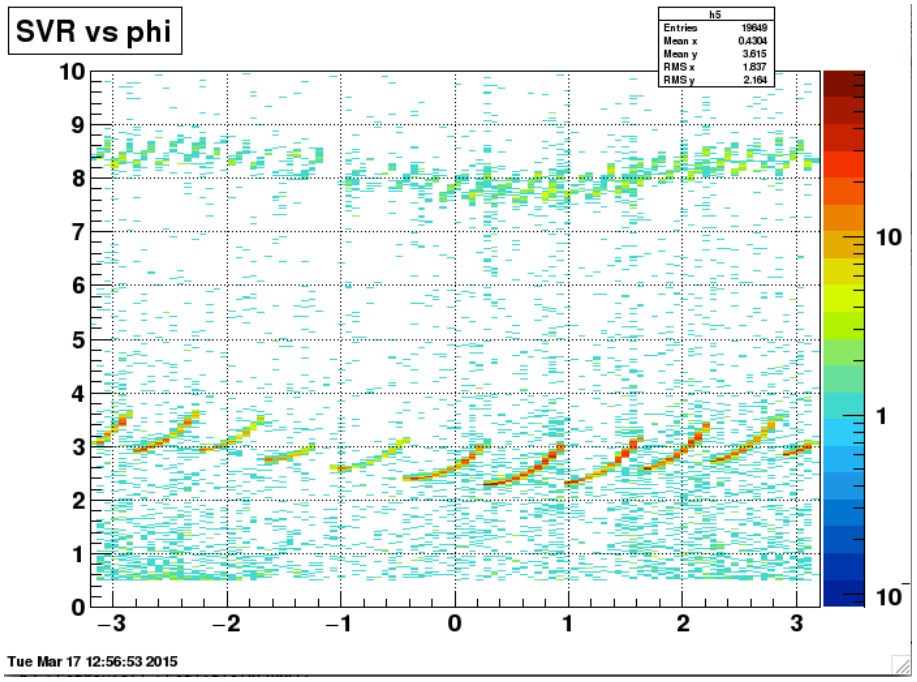
Sqrt(SVY*SVY + SVX*SVX)

The summary of pairs cuts that we concluded from the previous slides are below.

- Cos(θ) > 0.98
- DCAT <0.1 cm
- SIGN < 0
- Mass < 0.06
- SVR >=0.5
- PXL12 >0

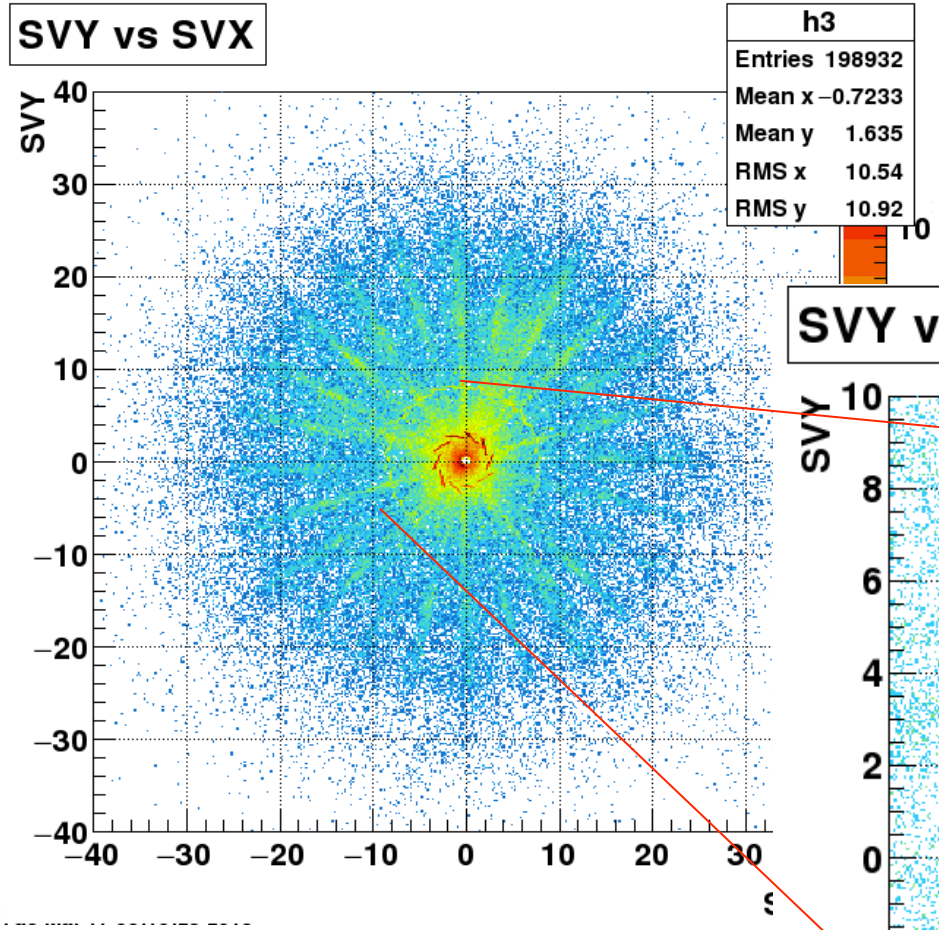
Applying these cuts on the next slide





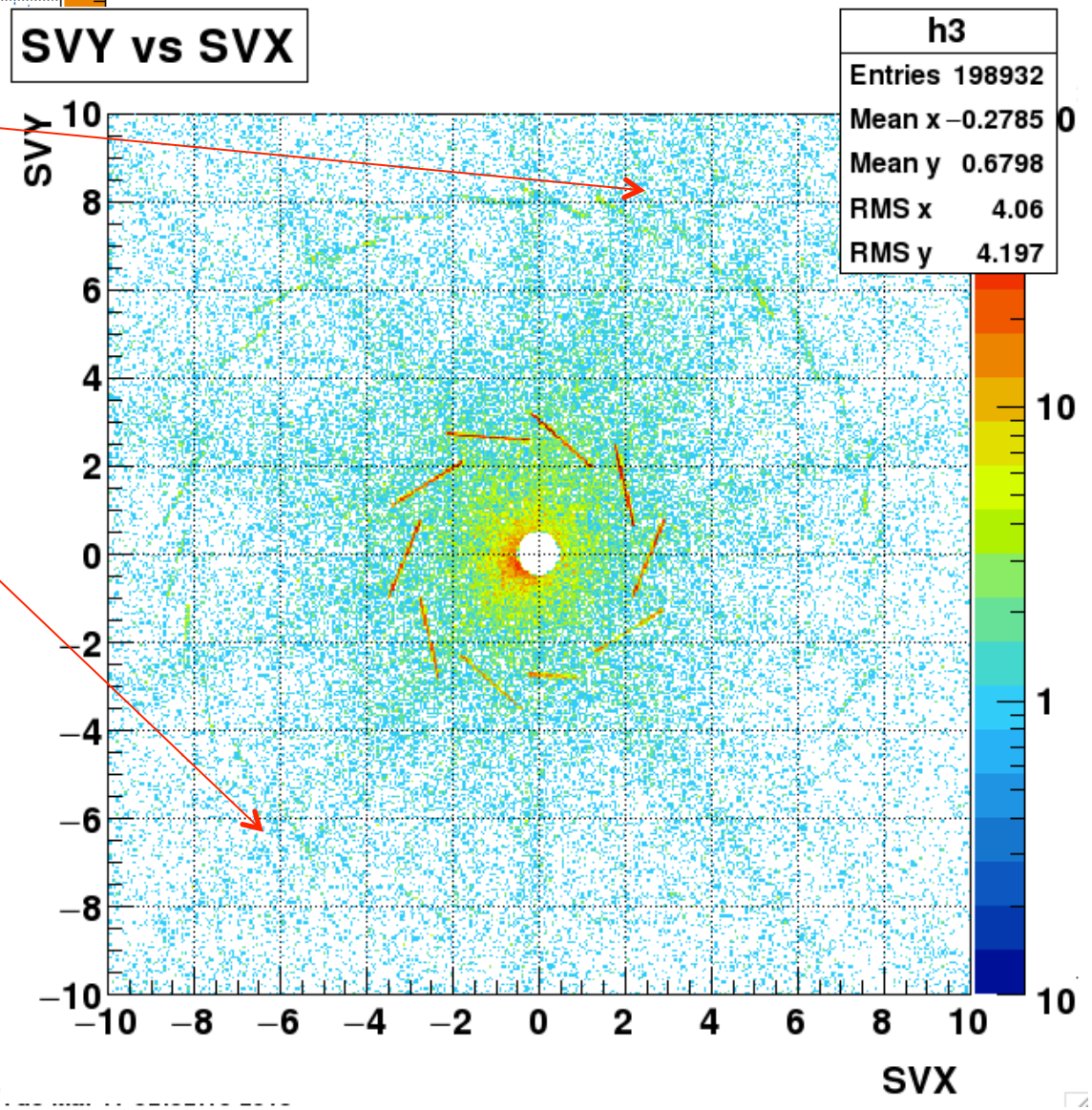
Sqrt(SVY*SVY + SVX*SVX)

- The first layer starts ~2.6cm. The peak [left panel] at ~2.3 is NOT the pipe but still the first layer [see right panel].
- This is because the SVX,SVY [reco vertex coords] are relative to event vertex and not in Global coords. We need to add vtx and vty to them.



(Y VS X) component of secondary verte

The optimized cuts helped to clean more comparing with slide 5. Now we could see the pxl 2 and pxl1.

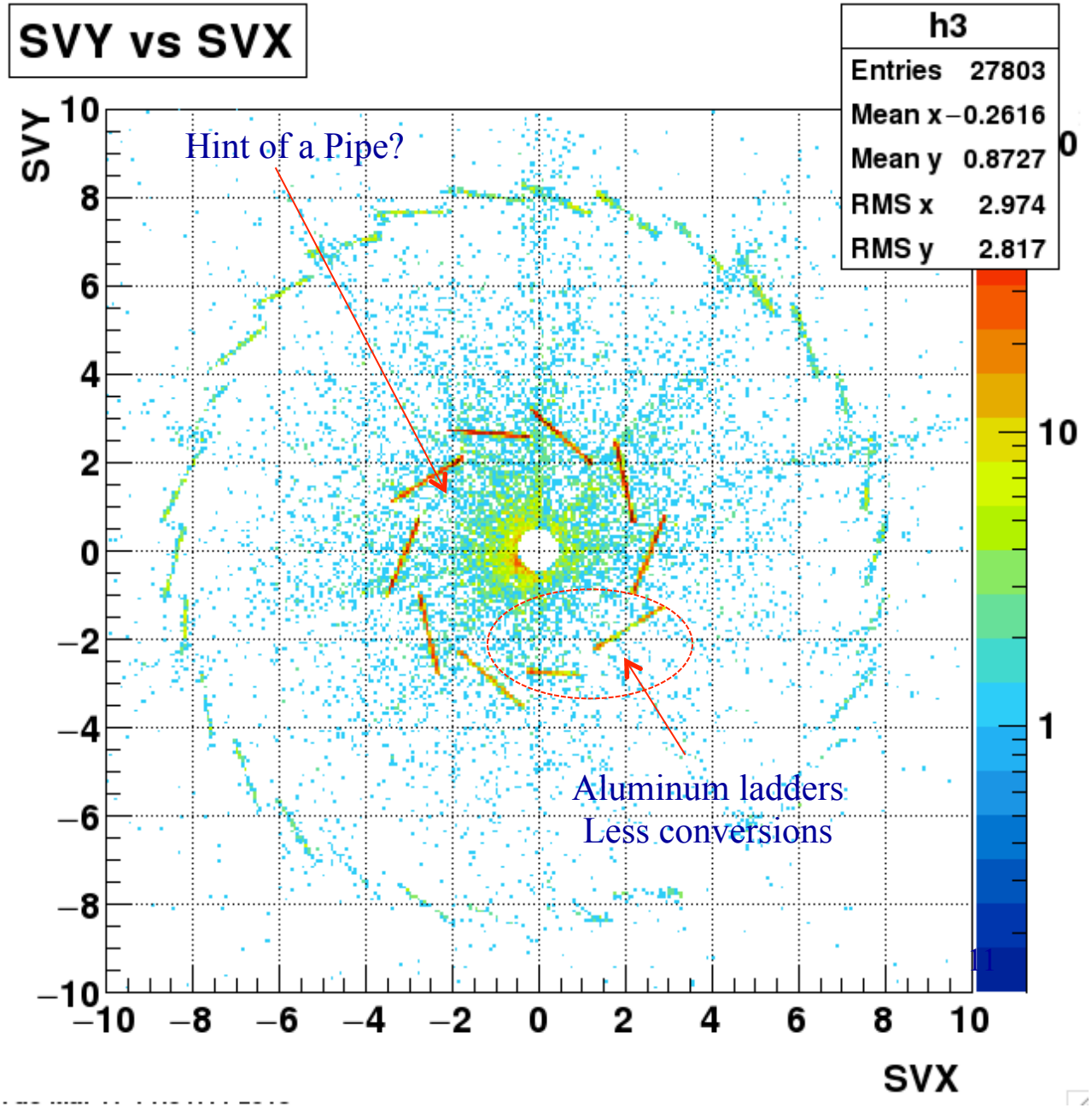


- Cos(θ) > 0.98
- DCAT <0.5 cm
- SIGN < 0
- Mass < 0.06
- SVR >=0.5

STAR

The optimized cuts helped to clean more comparing with slide 5.
Now we could see the pxl 2 and pxl1.

- Cos(θ) > 0.98
- DCAT <0.1 cm
- SIGN < 0
- Mass < 0.06
- SVR >=0.5
- PXL1,2 >0



SUMMARY

- The beam pipe should be visible, it is a question of statistics and cut optimization
  - Beam pipe is ~0.25% X0 and Al Ladder ~0.35%

- By comparing densities we should be able to estimate real mass in central region